



# Making the Most of **CBRS** **SPECTRUM**

Edition 2

Products, Solutions and Services that  
Simplify CBRS Network Deployments  
and Operations

**WE SIMPLIFY**  **5G**  
THE EVOLUTION TO

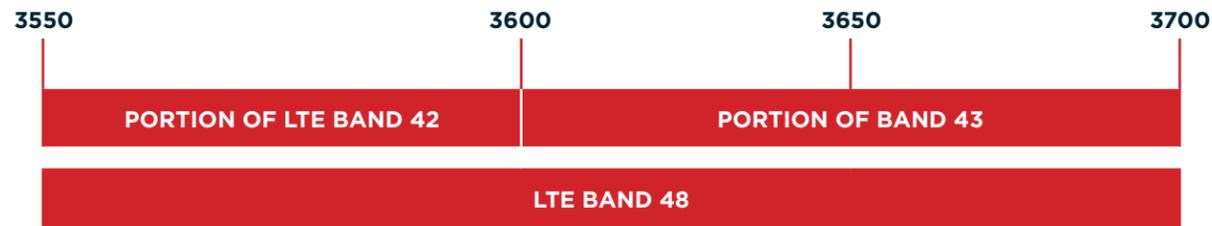
# CBRS SPECTRUM UNLEASHES NEW OPPORTUNITIES FOR NETWORK OPERATORS AND ENTERPRISES

Citizens Broadband Radio Service (CBRS) is the 150 MHz spectrum band between 3550 MHz and 3700 MHz that's now available for shared commercial use in the U.S. It's often referred to as the 3.5 GHz band and it's branded as OnGo by the CBRS Alliance, the industry standards group for CBRS.

## CBRS IS THE SPECTRUM BETWEEN 3550 MHZ AND 3700 MHZ

With access to shared CBRS spectrum:

- Mobile network operators and wireless internet service providers (WISPs) can enhance and extend network capacity and coverage to improve quality of service, support new applications and reach additional customers.
- Enterprises can build a private LTE network that's fully aligned with their operations and business goals.



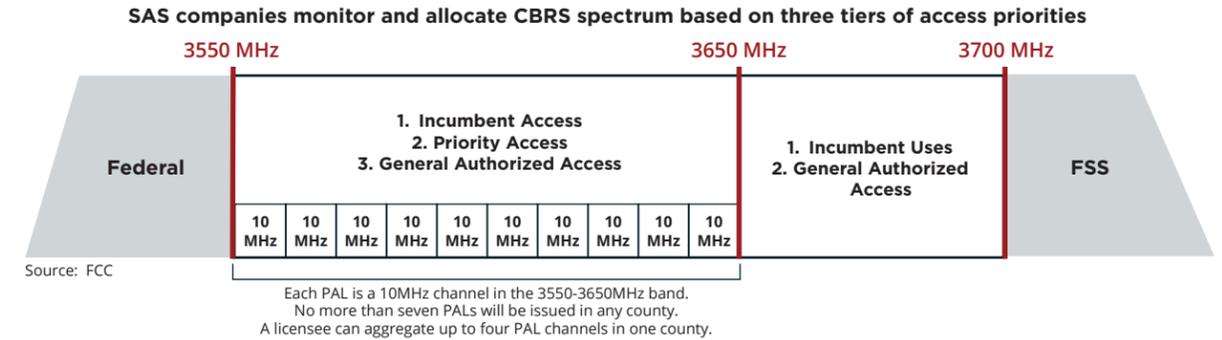
Regional Spectrum Access System (SAS) companies coordinate secure access to shared CBRS spectrum among all of the various organizations with access rights. SAS companies monitor spectrum requests from CBRS devices and dynamically allocate spectrum according to the three tiers of access priorities defined by the Federal Communications Commission (FCC).

## SAS COMPANIES MONITOR AND ALLOCATE CBRS SPECTRUM BASED ON THREE TIERS OF ACCESS PRIORITIES

**Incumbent Access.** Existing CBRS spectrum users, such as the U.S. Department of Defense and U.S. naval radar applications, have permanent priority. Other incumbents include earth stations with satellite uplinks in the CBRS band.

**Priority Access.** Organizations that pay for a Priority Access License (PAL) for one or more 10 MHz CBRS channels on a county-by-county basis.

**General Authorized Access.** CBRS spectrum that is available for general use.



## ENTERPRISES BUILDING A PRIVATE LTE NETWORK GAIN HUGE POTENTIAL, BUT FACE NEW CHALLENGES

Enterprises that take advantage of CBRS spectrum in a private LTE network have access to a cellular network that's completely independent from mobile operators, and the potential to set up roaming arrangements. With their own cellular network, enterprises have new freedom and flexibility to:

- Increase wireless network coverage and capacity across their organization and target areas where cell signals are weak or non-existent
- Improve security, reliability, mobility and latency for business-critical applications that currently rely on Wi-Fi connectivity
- Leverage innovative new applications and connectivity solutions that are tailored for their needs
- Manage the way bandwidth is used within their organization
- Offer value-added applications and services to tenants, guests and visitors

However, while there are many benefits to a private cellular network, building and operating a telecom network is new territory for most enterprises. And they can't afford to get it wrong.

To make the most of CBRS spectrum and their network investments, enterprises deploying a private LTE network need an experienced telecom partner that reduces risks at every stage of CBRS network deployment, operation and management.

## AN EXPERT PARTNER WITH THE RIGHT PRODUCTS AND SOLUTIONS SIMPLIFIES CBRS NETWORK EVOLUTION

Every organization that wants to make the most of CBRS spectrum — whether they're an experienced network operator or an enterprise building a network for the first time — can benefit from a partner that brings them:

- Deep understanding of CBRS network technologies and architectures
- CBRS products and solutions that are engineered from the ground-up to optimize use of spectrum and space while reducing capital costs
- A complete suite of CBRS network services, from network design and installation through network operation, monitoring and management

**CBRS has caused a ripple of excitement across the industry, and understandably so, as it has the potential to be a real game changer.**



# CBRS NETWORKS BENEFIT ALMOST EVERY INDUSTRY

Here's a quick look at just a few of the many ways CBRS networks can be used across industries.

INDUSTRY	CBRS NETWORK APPLICATIONS
<b>Telecom</b>   Mobile broadband networks	<ul style="list-style-type: none"> <li>• Improve indoor coverage and reduce dead zones</li> <li>• Increase throughput</li> <li>• Densify networks with additional small cells</li> </ul>
<b>Telecom</b>   Fixed wireless networks	<ul style="list-style-type: none"> <li>• Provide an easier, less expensive alternative to fiber for last-mile connections</li> <li>• Bring broadband to underserved and rural areas</li> <li>• Offer point-to-point CBRS as a cost-effective fiber replacement for Cloud-RAN (C-RAN) deployments</li> </ul>
<b>Manufacturing</b>   Industrial IoT solutions	<ul style="list-style-type: none"> <li>• Real-time robotic motion control</li> <li>• Automating warehousing and logistics tasks</li> <li>• Monitoring equipment efficiency and utilization</li> </ul>
<b>Energy and Utilities</b>	<ul style="list-style-type: none"> <li>• Connect Advanced Metering Infrastructure (AMI) such as smart meters</li> <li>• Enhance and extend Field Area Networks (FANs) to support smart grid applications</li> <li>• Accelerate supervisory control and remote data acquisition (SCADA) and remote telemetry applications</li> </ul>
<b>Air Travel</b>	<ul style="list-style-type: none"> <li>• Keep ground crews and pilots connected and informed</li> <li>• Provide point-of-sale and broadband services to airport tenants</li> <li>• Offer broadband access and engaging applications to travelers</li> </ul>
<b>Sports and Entertainment</b>	<ul style="list-style-type: none"> <li>• Offer interactive applications to guests and visitors</li> <li>• Improve communications among facility staff</li> <li>• Deploy wireless security systems and public safety applications</li> </ul>
<b>Healthcare</b>	<ul style="list-style-type: none"> <li>• Provide doctors and nurses with mobile voice, video, data and text communications</li> <li>• Track medical equipment movements to increase efficiency and protect against theft</li> <li>• Monitor patients' movements to increase their safety and security</li> </ul>
<b>Multi-dwelling Units</b>	<ul style="list-style-type: none"> <li>• Automate lighting, heating, ventilation and air conditioning in common areas</li> <li>• Improve security with wireless video cameras and monitoring systems</li> <li>• Connect maintenance and operations staff with voice and data communications</li> </ul>
<b>Education</b>	<ul style="list-style-type: none"> <li>• Provide indoor wireless coverage for faculty, staff and students</li> <li>• Leverage IoT solutions for indoor and outdoor monitoring and control</li> <li>• Support temporary outdoor events with point-of-sale, video and data services</li> </ul>



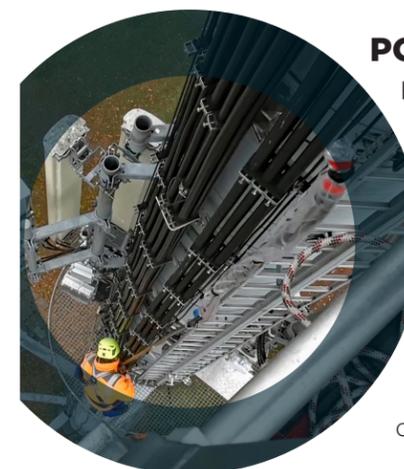
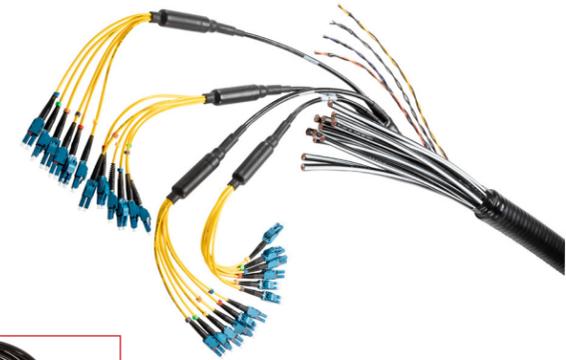
# RFS SIMPLIFIES EVERY ASPECT OF CBRS NETWORK DEPLOYMENTS AND OPERATIONS

RFS builds on more than 120 years of experience partnering with our customers to advance and evolve communications networks. We combine our unparalleled experience with our deep understanding of radio frequency technologies to provide products, solutions and services that help organizations in every industry make the best possible use of CBRS spectrum outdoors and indoors.

## FIBER AND POWER INFRASTRUCTURE SOLUTIONS INCREASE CAPACITY, LOWER CAPITAL COSTS

Our CBRS infrastructure solutions include:

- Hybrid cables, custom tailored combinations of optical fiber, power or other elements
- Optical Fiber Assemblies, single or multi-pair, trunk or jumper
- Multi-conductor armored or unarmored power cables
- Custom junction and distribution boxes
- Accessories such as connectors, clamps and hangers



### PORTFOLIO SPOTLIGHT

#### HYBRIFLEX® cables and jumpers

HYBRIFLEX hybrid power and fiber cables and jumpers reduce installation time, costs, complexity and weight for remote radio head (RRH) deployments. They're well-known in the industry for their best-in-class bending radius, robust construction, corrosion-resistance and strong core retention force. For maximum efficiency, HYBRIFLEX cables use the same installation procedures and accessories as coax cables.

We offer numerous standard HYBRIFLEX configurations and can easily adapt our designs to meet specific requirements for power, fiber, connectors and length.



Making the Most of **CBRS SPECTRUM**

# RFS SIMPLIFIES EVERY ASPECT OF CBRS NETWORK DEPLOYMENTS AND OPERATIONS

## CABLING AND PASSIVE COMPONENTS OPTIMIZE USE OF CBRS SPECTRUM

Our passive CBRS cabling and antenna solutions include:

- Coax cables (low-loss foam and plenum-rated) to feed CBRS and distributed antenna systems (DAS)
- RADIAFLEX® radiating cables for indoor and underground environments
- CBRS and 5G-ready passive components that support frequencies from 555 MHz to 6 GHz for LTE License Assisted Access (LAA) applications
- CBRS indoor antennas that provide omnidirectional, directional and narrow-beam coverage, and support frequencies up to 6 GHz
- Professional-grade Wi-Fi antennas
- High, performance booted and cluster jumper assemblies
- Omni, panel and narrow-beam antennas for SISO and MIMO applications
- A wide range of connectors and accessories to support your deployments



### PORTFOLIO SPOTLIGHT

RADIAFLEX® radiating cables

RADIAFLEX cables are the only radiating cables on the market to support all frequencies between 610 MHz and 3.8 GHz with no stopbands, making them ideal to take advantage of CBRS spectrum in buildings, tunnels and other underground environments. They meet the industry's most stringent fire safety standards and are trusted to provide wireless capacity and coverage in more than 40% of the world's metros as well as major road tunnels.

In 2018, RADIAFLEX cables were used to set an in-tunnel world record download speed of 560 Mbps on the Follo line high-speed rail project in Norway. That speed is approximately 95 percent of theoretical maximum speed for 4x4 MIMO in the tunnel.

At RFS, we have 120 years' experience taking our customers through the evolution of telecoms. From the advent of wireless technology, to the latest 5G we have a core understanding of how the industry landscape shifts and how to help our customers make the most of new developments, while minimizing the risk of their investments.



## SERVICES MINIMIZE THE BURDEN ON YOUR ORGANIZATION AND REDUCE RISKS

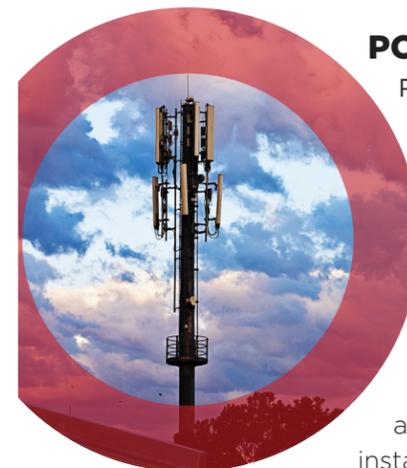
Our end-to-end services for CBRS networks and the associated carrier-grade Wi-Fi networks put our experience and expertise to work for your business:

- **Consulting services** identify connectivity and coverage needs, define use cases and recommend applications to improve operational efficiency.
- **Design services** ensure CBRS and Wi-Fi networks meet service level agreements (SLAs).
- **Installation services** by our certified installers streamline deployments.
- **Commissioning and optimization services** ensure CBRS and Wi-Fi network devices operate properly and that interference is not an issue.
- **Integration services** ensure that all network functionality, including backhaul and evolved packet core (EPC) functionality, operates properly.

## SPACE-EFFICIENT, MULTI-BAND ANTENNAS SUPPORT NEXT-GENERATION VOICE AND DATA-RICH WIRELESS SERVICES

Our CBRS antenna solutions include:

- CBRS and C-band base station antennas
- RF X-TREME™ small cell antennas
- Microwave antennas for backhauling



### PORTFOLIO SPOTLIGHT

RF X-TREME small cell antennas

RF X-TREME small cell antennas feature an ultra-broadband design that's ideal for neutral host applications as well as 4x4 MIMO and 4-way receive diversity applications. For maximum flexibility, these innovative antennas are cross-polarized with 7 arrays and offer 14 ports to support frequencies ranging from 694 MHz to 5925 MHz.

RFS' lightweight and versatile 5G small cell base station antennas make it easy to improve coverage and capacity at high-traffic, indoor-outdoor venues. RFS antennas feature a lightweight design to reduce the small cell footprint and simplify installation. Panel and omni-directional versions are available.



# RFS PRODUCTS: PUTTING OUR RF EXPERTISE TO WORK FOR CBRS

## Plenum, Coaxial and Radiating Cables

MODEL NUMBER	DESCRIPTION	FREQUENCY RANGE
<a href="#">ICA12-50JPLR</a>	1/2" Red Copper Plenum-Rated Air-Dielectric Coax Cable; In-Building Applications	Up to 6000 MHZ
<a href="#">ICA12-50JPLLR-ARMR</a>	Armored 1/2" Red Plenum-Rated Air-Dielectric Coax Cable; In-Building Applications	Up to 6000 MHZ
<a href="#">ICA12-50JPLLR</a>	1/2" Red Aluminum Plenum-Rated Air-Dielectric Coax Cable; In-Building Applications	Up to 6000 MHZ
<a href="#">2HB12-50JPLR</a>	DragonSkin 1/2" Fire-Resistant UL 2196 Certified Standalone Coaxial Cable	Up to 1000 MHZ
<a href="#">SCF14-50JFN</a>	1/4" Superflexible Coaxial Cable; flame retardant/halogen free jacket	Up to 6000 MHZ
<a href="#">SCF14-50J</a>	1/4" Superflexible Coaxial Cable; standard jacket	Up to 6000 MHZ
<a href="#">RCF12-50JFN</a>	1/2" RADIAFLEX® Radiating Cable; Milled (Two-Row) Design	Up to 6000 MHZ
<a href="#">RLKX114-50JFLAB</a>	1-1/4" RADIAFLEX® Radiating Cable; Groups of Vertical Slots at Short Intervals	Up to 4200 MHZ

## Fiber Solutions

MODEL NUMBER	DESCRIPTION
<a href="#">FR-N-1SM-01-xxF</a>	Optical Fiber Cable, 1 Pair, Single-Mode Fiber, DLC Connectors
<a href="#">FR-N-2SM-01-xxF</a>	Optical Fiber Cable, 2 Pair, Single-Mode Fiber, DLC Connectors
<a href="#">FR-N-3SM-01-xxF</a>	Optical Fiber Cable, 3 Pair, Single-Mode Fiber, DLC Connectors
<a href="#">FR-N-6SM-01-xxF</a>	Optical Fiber Cable, 6 Pair, Single-Mode Fiber, DLC Connectors
<a href="#">FR-N-12SM-01-xxF</a>	Optical Fiber Cable, 12 Pair, Single-Mode Fiber, DLC Connectors



## Base Station Antennas

MODEL NUMBER	FREQUENCY RANGE, MHZ	PORTS	GAIN, DBI	HORIZONTAL BEAMWIDTH, DEG	TILT RANGE, DEGREES
<a href="#">PH-YY10-N0</a>	3300-3800/ 3300-3800	4	17.7 and 17.8	65	2-12
<a href="#">PH-LLYY15-N0</a>	1710-2690/ 2x 3300-3800	4	18.1/18.1/18.4/18.4	65	2-12
<a href="#">APXV9TY10AB_43-C-I20</a>	3300-3800MHz	8	15.5/13.2/19.3	90	2-12
<a href="#">P-BBLLYYZ06-01</a>	694-960/694-960 1695-2690/ 1695-2690/3300-4200/ 3300-4200/5150-5925MHz	14	7.5/7.3/14.0/14.0/ 10.6/10.5/5.4	65	Fixed
<a href="#">O-BBLLYYZ06-01</a>	694-960/694-960/1695-2690/ 1695-2690/3300-4200/ 3300-4200/5150-5925	14	3.8/3.8/10.0/ 10.1/6.8/6.9/5.9	360	Fixed
<a href="#">SP-LLYYZ06-F0</a>	1695-2690/2x 3300-4200/ 5150-5925	10	13.2/13.8/14.2/ 14.4/14.9	65	Fixed
<a href="#">SO-LLYYZ06-F0</a>	2x 1695-2690/ 2x 3300-4200/5150-5925	10	9.5/9.6/9.8/ 10.5/10.5	365	Fixed

## Multi-Band Diplexers

MODEL NUMBER	FREQUENCY	CONFIGURATION	REJECTION, DB	RF CONNECTORS
<a href="#">FDFX55020S4-2C</a>	Path 1: 80-2690 MHz Path 2: 3300-5925	Single	50	4.3-10 (F)
<a href="#">FDFX55020S2-2C</a>				2.2-5 (F)
<a href="#">FDFX55020D4-2C</a>		Dual		4.3-10 (F)
<a href="#">FDFX55020D2-2C</a>				2.2-5 (F)

Learn more about RFS solutions — visit our brochure library on our website: [HERE](#)



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